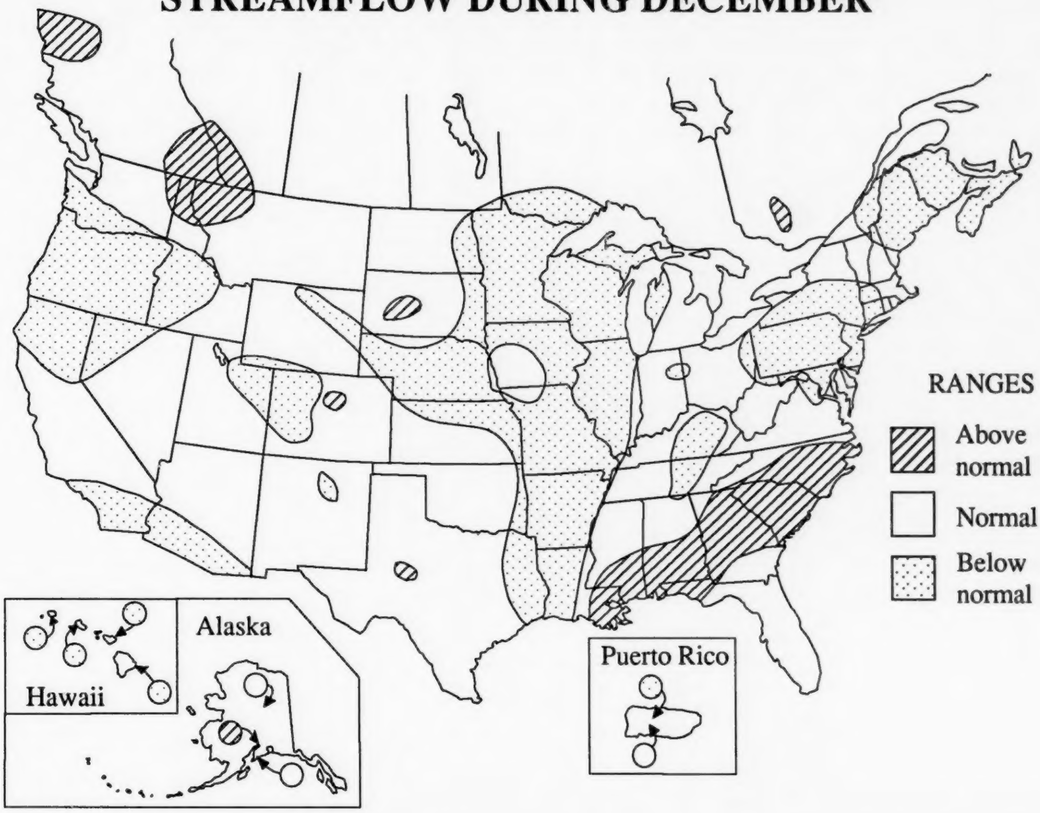
National Water Conditions

UNITED STATES
Department of the Interior
Geological Survey

CANADA
Department of the Environment
Water Resources Branch

DECEMBER 1989

STREAMFLOW DURING DECEMBER



Streamflow was in the normal to above-normal range at 53 percent of the 191 reporting index stations in southern Canada, the United States, and Puerto Rico during December. Below-normal range streamflow occurred in 29 percent of the area of southern Canada and the conterminous United States during December. Total December flow for the 181 reporting index stations in the conterminous United States and southern Canada was 21 percent below median. New December lows occurred at index stations in Wisconsin, Iowa, and Nebraska.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged 19 percent below median and in the normal range during December.

Monthend index reservoir contents for December 1989 were in the below-average range at 36 of 100 reporting sites. Contents were in the above-average range at 33 reservoirs.

Mean December elevations at the four master gages on the Great Lakes (provisional National Ocean Service data) were in the normal range except on Lake Superior, which was in the below-normal range.

Utah's Great Salt Lake remained at the same level as on November 30.

STREAMFLOW CONDITIONS DURING DECEMBER 1989

Streamflow was in the normal to above-normal range at 53 percent of the 191 reporting index stations in southern Canada, the United States, and Puerto Rico during December, compared with 79 percent of stations in those ranges during November, and 60 percent of stations in those ranges during December 1988. Below-normal range streamflow occurred in 29 percent of the area of southern Canada and the conterminous United States during December compared with 10 percent during November. Total December flow of 1,268,300 cubic feet per second (cfs) for the 181 reporting index stations in the conterminous United States and southern Canada was 21 percent below median after a 19 percent decrease in streamflow from November to December, and 5 percent less than flow during December 1988.

Three new monthly lows occurred at streamflow index stations during December (see table on page 4), compared with five new extremes during November. The new lows were at index stations in Wisconsin, Iowa, and Nebraska. Hydrographs for those three index stations and four others are shown on page 5. The other hydrographs are for: an index station in Colorado at which the monthly mean was 68 percent of median and equaled the December low of record (set in 1898); and for three index stations in Wisconsin at which the monthly means were 39 percent, 45 percent, and 53 percent of median, respectively, with means at the latter 2 stations also being the third lowest of record for December.

Streamflow conditions during December 1989 and December 1988 are shown by maps on page 6. The overall percentage of area in each flow range in southern Canada and the conterminous United States is about the same for each month, but the spatial distribution of areas in the three flow ranges is dissimilar. In 1989, the Southeast, southwestern Canada and the adjacent States are generally "wetter," while the Southwest, eastern Canada, and the adjacent States are generally "drier."

Streamflow conditions for Fall 1989 and Fall 1988 are shown by maps on page 7. The overall percentage of area in each flow range is about the same for each month, but the spatial distribution of areas in the three flow ranges is dissimilar, approximating the contrasts between the monthly maps cited previously.

Streamflow conditions for calendar year 1989 and calendar year 1988 are shown by maps on page 8. These maps are quite dissimilar. In 1989 there is about 10 times as much area in the above-normal range and about 60 percent as much area in the below-normal range as in 1988. Streamflow was in the normal to above-normal range at 66 percent of the index stations in southern Canada, the United States, and Puerto Rico for the calendar year.

Streamflow conditions in 5 areas affected by drought in 1988-89 are shown by graphs (calendar year) on page 9.

During the 1989 calendar year, the combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged 1,083,000 cfs (8 percent above median and in the normal range): about 33 percent more than for calendar year 1988, for which the average flow was in the below-normal range. Annual mean flow of the St. Lawrence River was 6 percent below median, but in the normal range. The annual mean flow of the Mississippi River was 19 percent above median, and in the above-normal range. Flow of the Columbia River was 10 percent below median and in the below-normal range.

(Continued on page 4)

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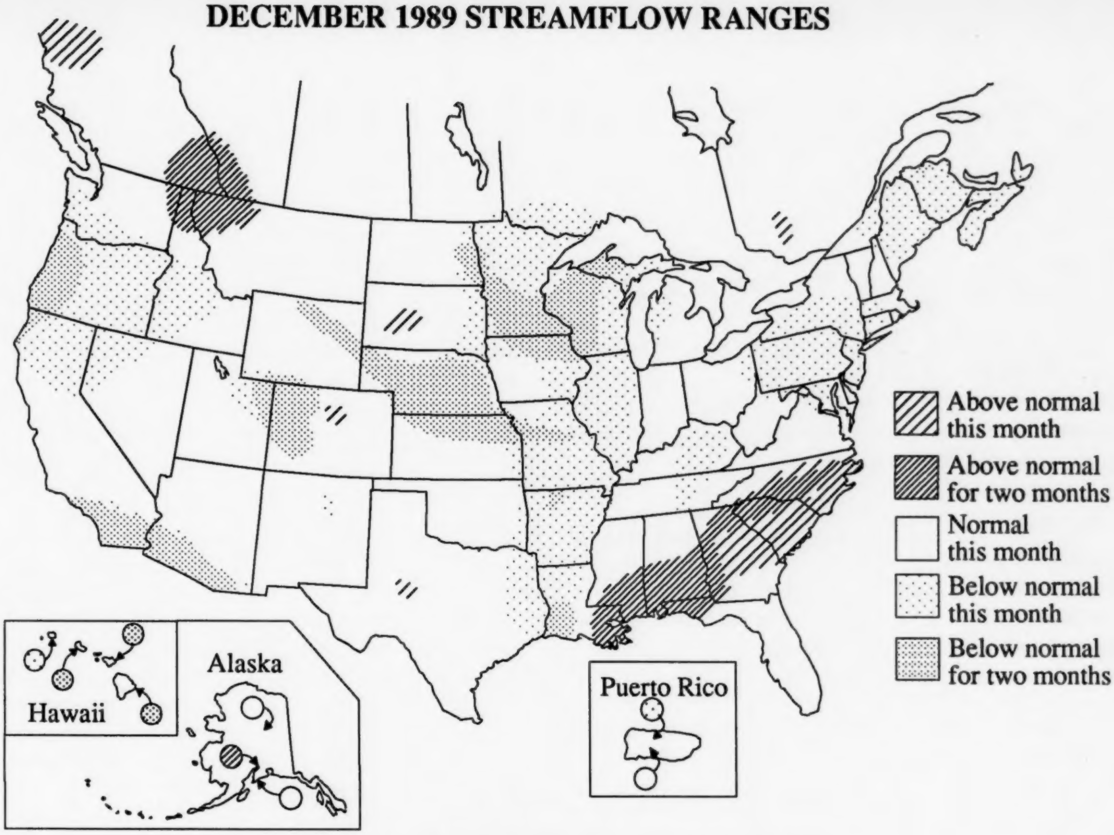
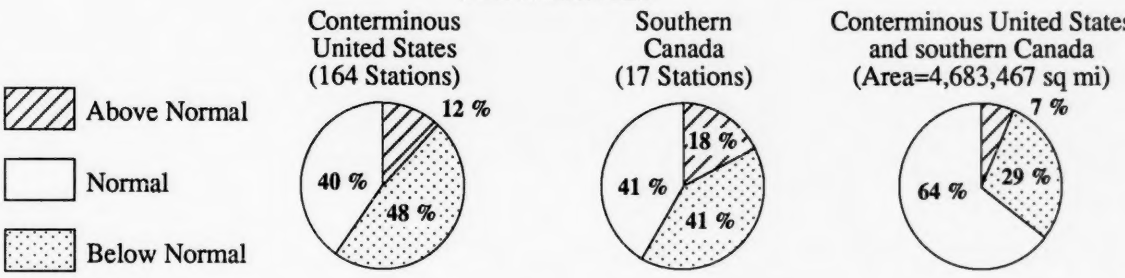
DECEMBER 1989 STREAMFLOW RANGES

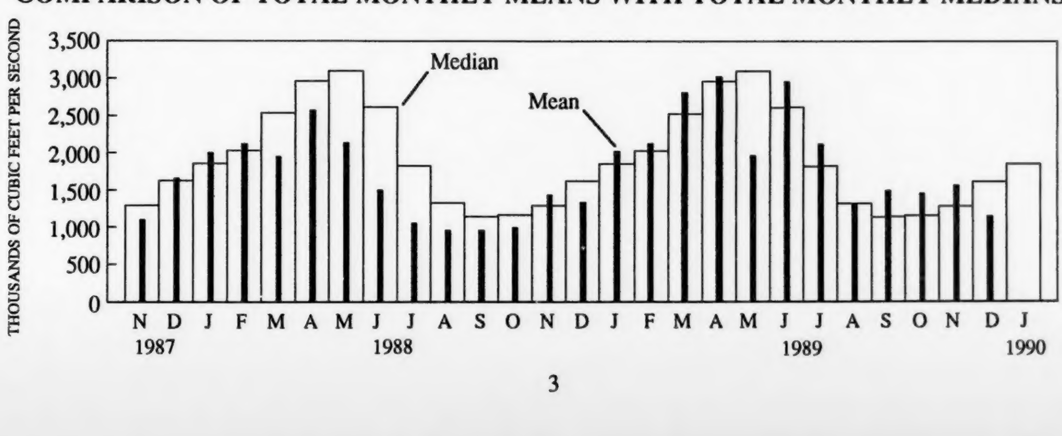


SUMMARY OF DECEMBER 1989 STREAMFLOW

FLOW RANGES



COMPARISON OF TOTAL MONTHLY MEANS WITH TOTAL MONTHLY MEDIANS



Provisional data; subject to revision

NEW MINIMUMS DURING DECEMBER 1989 AT STREAMFLOW INDEX STATIONS

Station number	Stream and place of determination	Drainage area (square miles)	Previous December extremes (period of record): Years of record	Monthly mean in cfs (year)	Daily mean in cfs (year)	December 1989: Monthly mean in cfs	Percent of median	Daily mean in cfs	Day
04071000	Oconto River near Gillett, Wisconsin	705	78	233 (1976)	116 (1920)	230	51	192	15
05464500	Cedar River at Cedar Rapids, Iowa	6,510	87	351 (1955)	212 (1949)	331	26	204	26
06454500	Niobrara River above Box Butte Reservoir, Nebraska	1,400	43	18.4 (1985)	10 (1985)	17.0	48	15.0	*

*Occurred more than once.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged 680,600 cfs (19 percent below median and in the normal range) during December, 18 percent less than during November. Flow of of all three rivers was in the normal range. Hydrographs for both the combined and individual flows of the "Big 3" are on page 10. Dissolved solids and water temperatures at five large river stations are also given on page 10. Flow data for the "Big 3" and 42 other large rivers are given in the Flow of Large Rivers table on page 11.

Monthend index reservoir contents for December 1989 were in the below-average range (below the monthend average for the period of record by more than 5 percent of normal maximum contents) at 36 of 100 reporting sites, compared with 33 of 100 during November 1989, including most reservoirs in Nebraska, North Dakota, Wyoming, Montana, Idaho, California, Nevada and Colorado. Contents were in the above-average range at 33 reservoirs (compared with 45 last month) , including most reservoirs in New Hampshire, Vermont, Massachusetts, New York, New Jersey, Maryland, the Carolinas, Georgia, Alabama, the Tennessee Valley, Oklahoma, and Arizona. Reservoirs with contents in the below-average range and significantly lower than last year (with normal maximum contents of at least 1,000,000 acre-feet) were: Allegheny, Pennsylvania; the Little Tennessee Projects, Tennessee Valley; International Falcon and Lake Travis, Texas; Lake McConaughy, Nebraska; Lake Oahe, South Dakota; Fort Peck, Montana; the Pathfinder and associated reservoirs, Wyoming; Bear Lake, Idaho-Utah; and Lake Berryessa, California. Lake Tahoe (California-Nevada) had no usable storage at the end of the month while both Rye Patch (Nevada) and San Carlos (Arizona) had only 6 percent of normal maximum contents. Graphs of contents for seven reservoirs are shown on page 12 with contents for the 100 reporting reservoirs given on page 13.

Precipitation for December 1989 (provisional National Weather Service data) is shown by maps (page 16). A historical perspective on December weather is given on page 17.

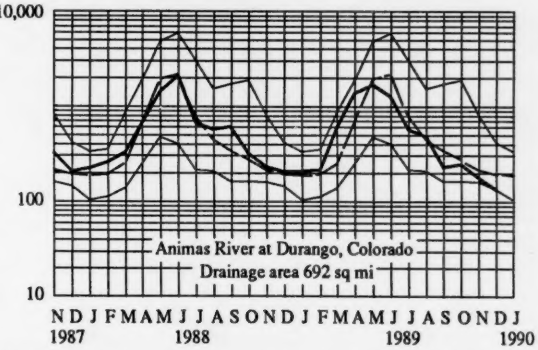
Mean December elevations at the four master gages on the Great Lakes (provisional National Ocean Service data) were in the normal range except on Lake Superior, which was in the below-normal range. Levels declined from those for November on all four lakes. December 1989 levels ranged from 0.36 foot (Lake Huron) to 0.21 foot lower (Lake Erie) than those for November. Monthly means on Lake Superior have now been in the below-normal range for 3 months. Monthly means have been in the normal range for 29 months on Lake Huron, 21 months on Lake Erie, and 8 months on Lake Ontario. December 1989 levels ranged from 0.40 foot higher (Lake Ontario) to 0.81 foot lower (Lake Huron) than those for December 1988. Stage hydrographs for the master gages on Lake Superior, Lake Huron, Lake Erie, and Lake Ontario are on page 18.

Utah's Great Salt Lake (graph on page 18) remained at 4,204.40 feet above National Geodetic Vertical Datum of 1929 throughout December, the same level as on November 30. The lake has declined 2.40 feet since the seasonal high of April 1-15, is 2.05 feet lower than at the end of December 1988, and 7.45 feet lower than the maximum of record which occurred in June 1986 and March-April 1987.

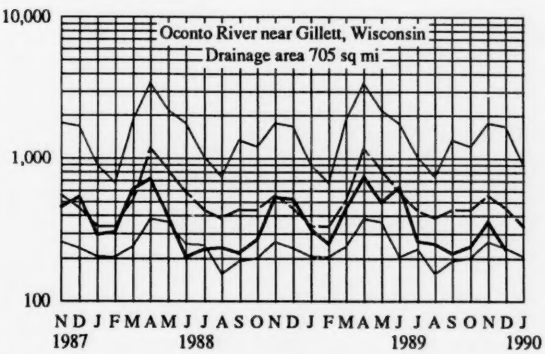
January-March 1990 outlook maps for both temperature and precipitation are on page 19. Temperature is likely to be above median in a large arcuate area extending from Washington to central New Mexico and extreme western Texas. Below-median temperatures are likely in an area extending from the central northern border of North Dakota southward to northwestern Louisiana and eastward to Virginia, including all States north of Virginia. Precipitation is likely to be above median in a large area extending from northern Montana through the central part of the Utah-Colorado border, and also in coastal areas of South Carolina, Georgia, and most of Florida. Below-median precipitation is likely in an area including southern California, southern Arizona, and the southwestern corner of New Mexico, and also in a large area extending from the western Great Lakes States to central Louisiana.

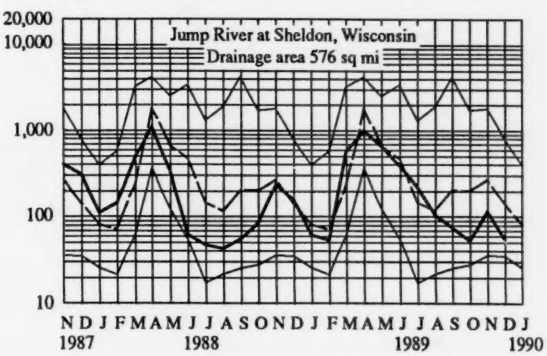
MONTHLY MEAN DISCHARGE OF SELECTED STREAMS

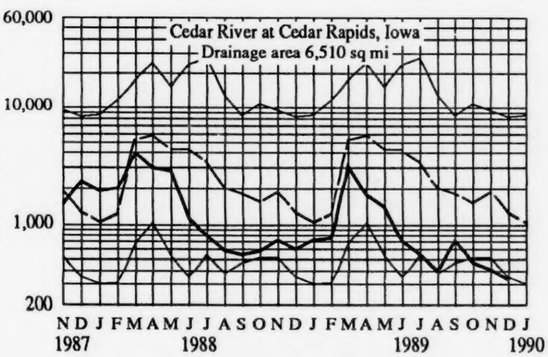
Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.

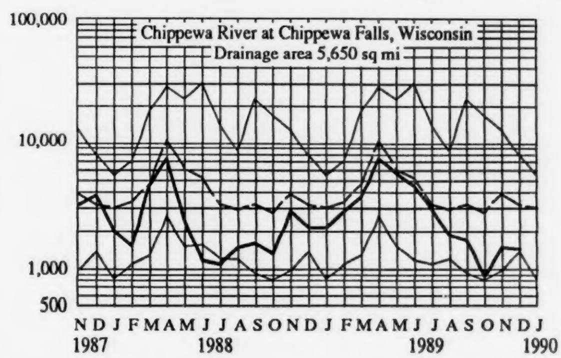


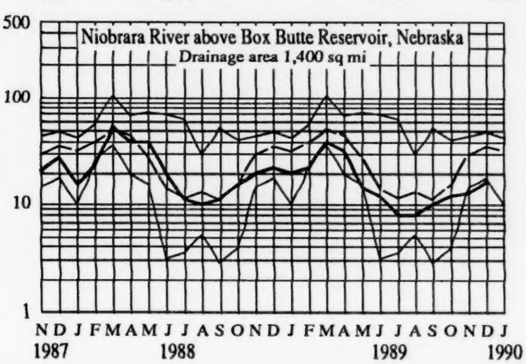
DISCHARGE IN CUBIC FEET PER SECOND

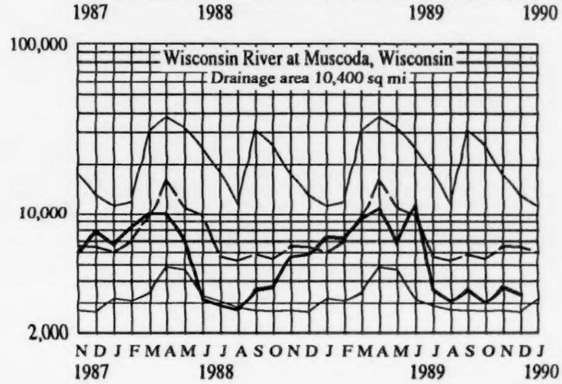


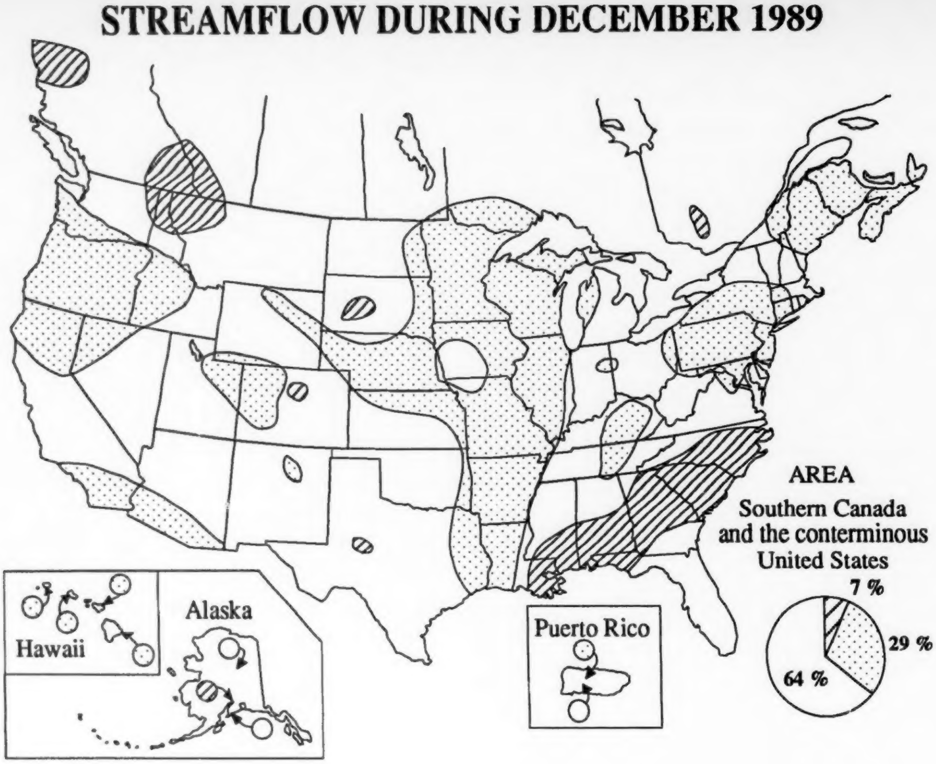


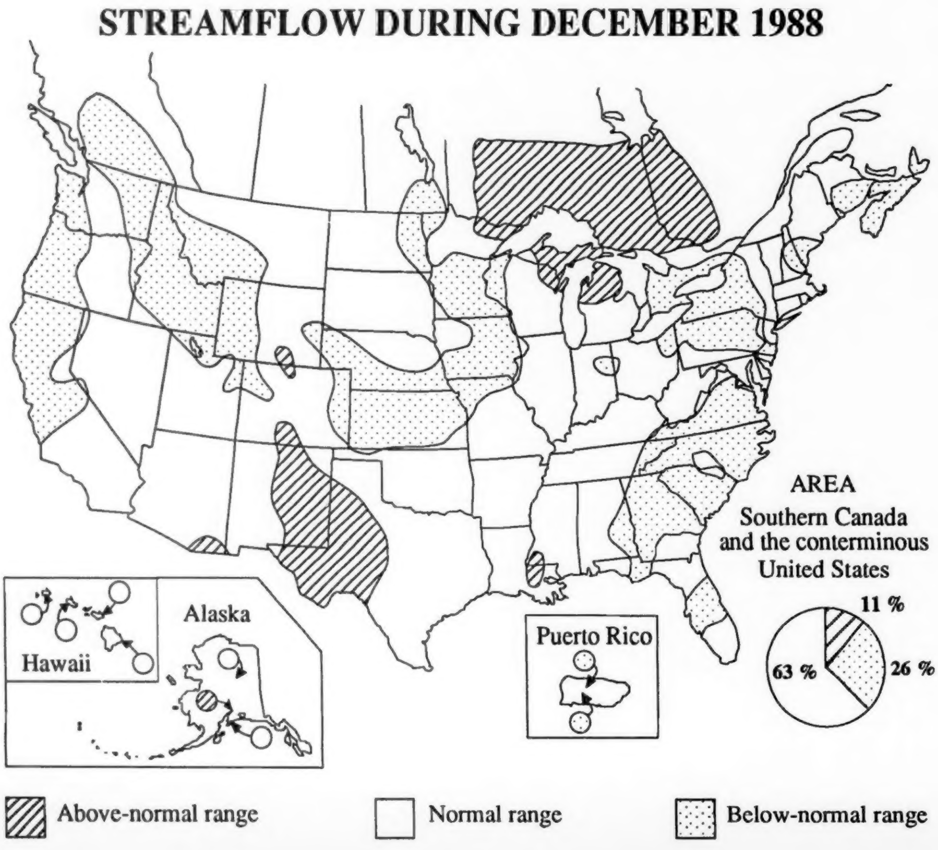






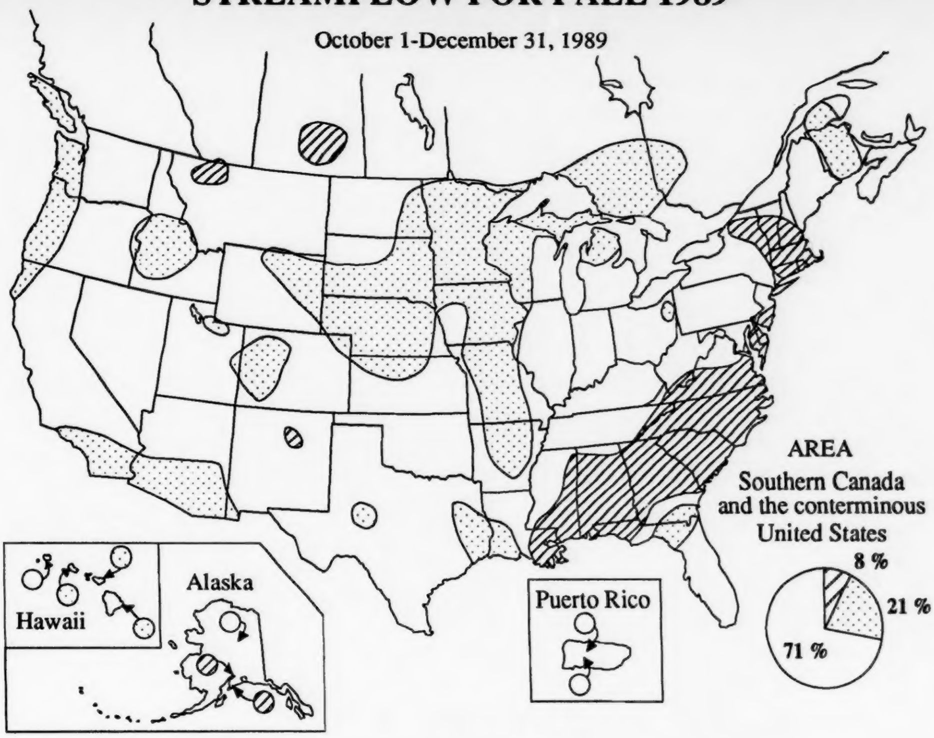



STREAMFLOW DURING DECEMBER 1989
AREA
Southern Canada
and the conterminous
United States
7 %
29 %
64 %
Hawaii
Alaska
Puerto Rico


STREAMFLOW DURING DECEMBER 1988
AREA
Southern Canada
and the conterminous
United States
11 %
26 %
63 %
Hawaii
Alaska
Puerto Rico
Above-normal range
Normal range
Below-normal range

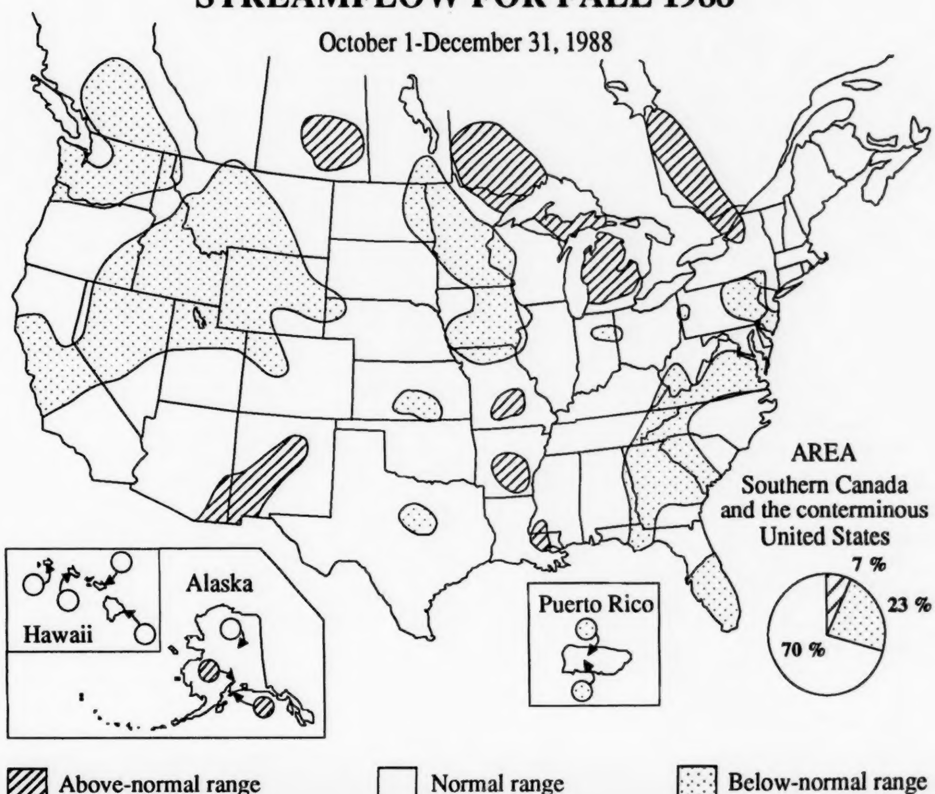
STREAMFLOW FOR FALL 1989

October 1-December 31, 1989

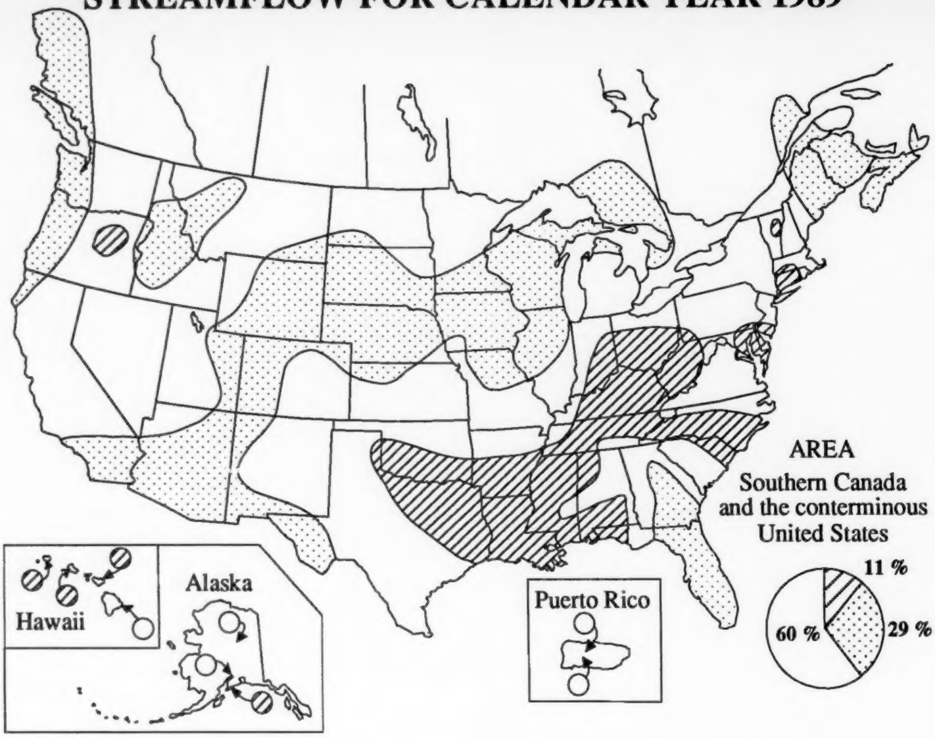


STREAMFLOW FOR FALL 1988

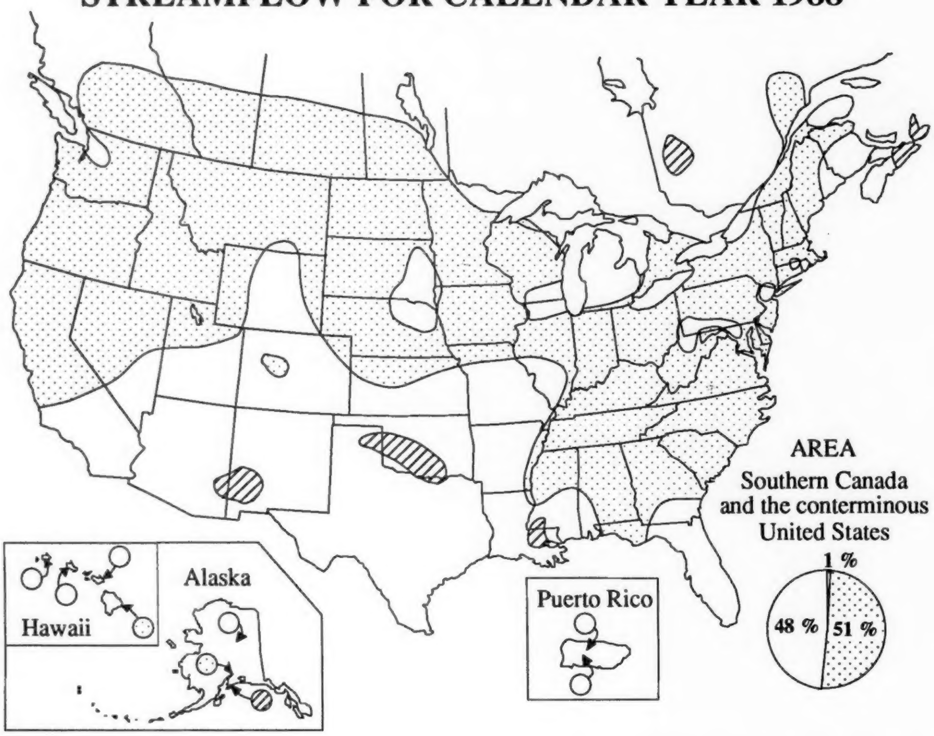
October 1-December 31, 1988



STREAMFLOW FOR CALENDAR YEAR 1989

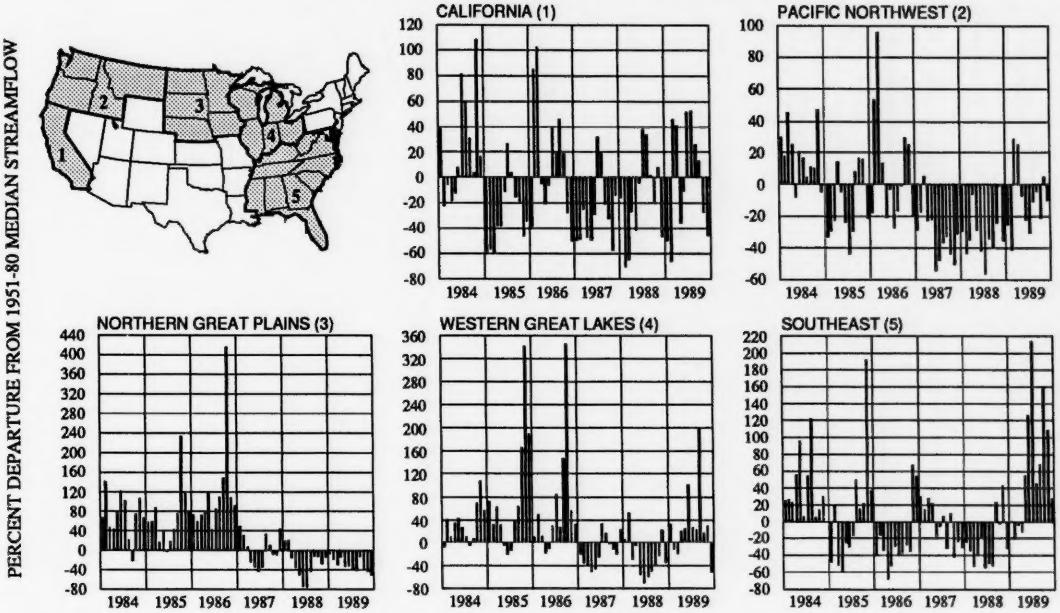


STREAMFLOW FOR CALENDAR YEAR 1988

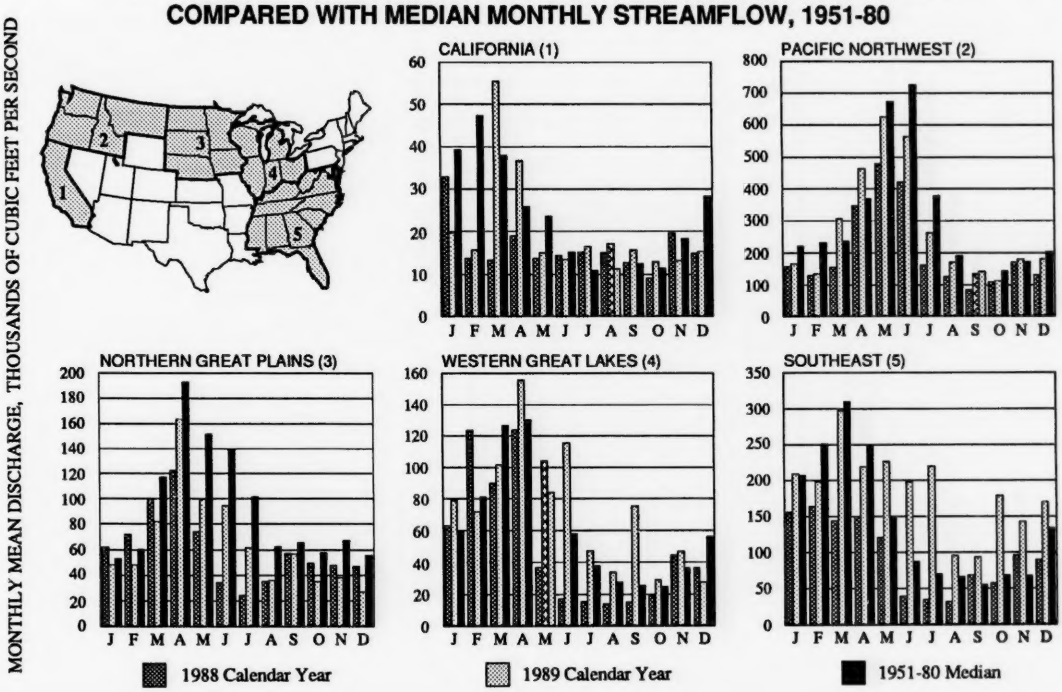


Above-normal range   Normal range   Below-normal range

MONTHLY DEPARTURE OF ACTUAL STREAMFLOW (JANUARY 1984-DECEMBER 1989) FROM MEDIAN STREAMFLOW (1951-80)

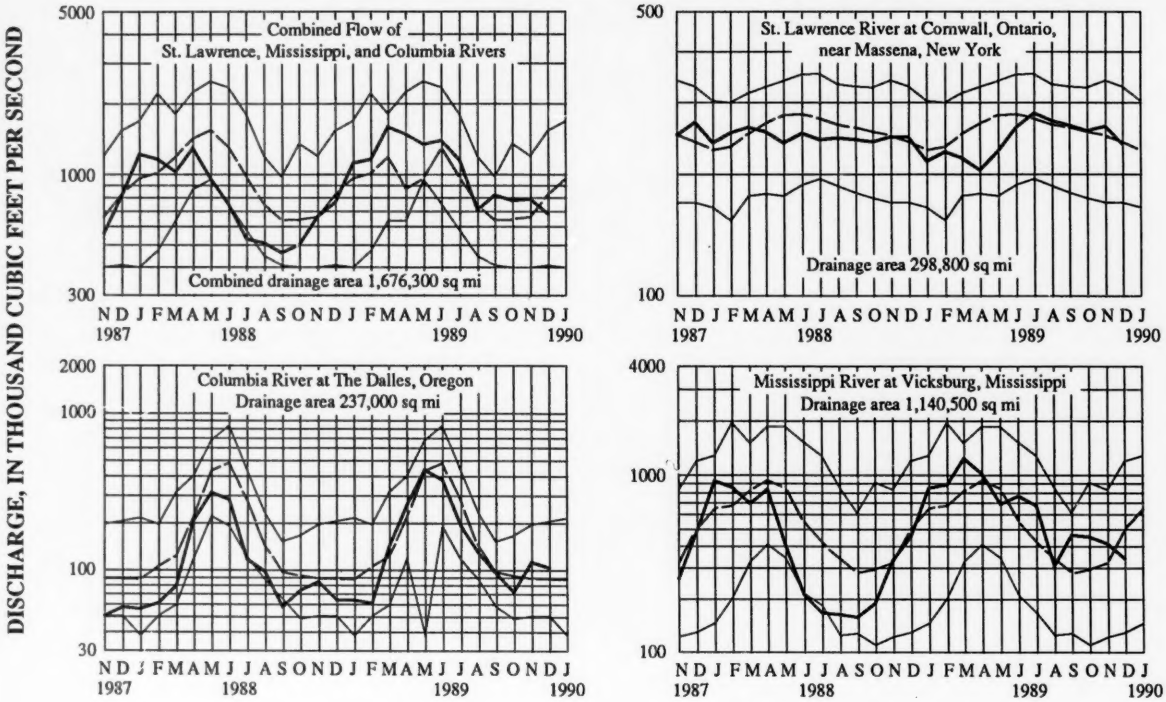


ACTUAL MONTHLY STREAMFLOW, 1988 AND 1989 CALENDAR YEARS, COMPARED WITH MEDIAN MONTHLY STREAMFLOW, 1951-80



HYDROGRAPHS FOR THE "BIG THREE" RIVERS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.



Provisional data; subject to revision

DISSOLVED SOLIDS AND WATER TEMPERATURES, FOR DECEMBER 1989, AT DOWNSTREAM SITES ON FIVE LARGE RIVERS

Station number	Station name	September data of following calendar years	Stream discharge during month	Dissolved-solids concentration[a]		Dissolved-solids discharge[a]			Water temperature[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean (tons per day)	Minimum (tons per day)	Maximum (tons per day)	Mean in °C	Minimum in °C	Maximum in °C
01463500	Delaware River at Trenton, N.J.	1989	5,465	103	137	1,757	1,347	2,549	1.0	0.0	4.0
	(Morrisville, Pa.)	1944-88	13,034	62	138	3,434[d]	631	20,500	3.5[d]	0.0	12.0
		(Extreme yr)		(1983)	(1980)		(1964)	(1973)			
			[c]11,650								
07289000	Mississippi River at	1989		......	......	......	......	......	...	...	...
	Vicksburg, Miss.	1975-88	710,600	153	343	402,000	130,500	712,800	7.5	0.0	13.0
		(Extreme yr)		(1978)	(1988)		(1988)	(1985)			
			[c]495,500								
03612500	Ohio River at lock and dam 53,	1989	192,700	171	235	......	71,500	180,000	...	2.5	12.0
	near Grand Chain, Ill. (streamflow station at Metropolis, Ill.)	1954-88	325,900	138	362	......	21,300	469,000	...	0.0	14.0
		(Extreme yr)		(1962)	(1969)		(1980)	(1977)			
			[c]286,000								
06934500	Missouri River at Hermann,	1989	21,600	341	494	26,200	18,000	30,600	2.5	0.0	5.5
	Mo. (60 miles west of	1975-88	77,890	222	770	77,280	20,200	237,000	3.5	0.0	14.0
	St. Louis, Mo.)	(Extreme yr)		(1982)	(1978)		(1988)	(1982)			
			[c]40,520								
14128910	Columbia River at Warrendale,	1989	140,000	95	111	39,400	28,500	49,800	8.0	5.5	10.0
	Oreg. (streamflow station at	1975-88	156,400	82	128	45,500	22,800	77,300	6.5	0.5	10.5
	The Dalles, Oreg.)	(Extreme yr)		(1975)	(1984)		(1978)	(1980)			
			[c]87,500								

[a]Dissolved -solids concentrations, when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 x °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1951-80, for comparison with data for current month.
[d]Mean for 6-year period (1983-88).

Provisional data; subject to revision

FLOW OF LARGE RIVERS DURING DECEMBER 1989

Station number	Stream and place of determination	Drainage area (square miles)	Average discharge through September 1985 (cubic feet per second)	December 1989: Monthly mean discharge (cubic feet per second)	December 1989: Percent of median monthly discharge 1951–80	December 1989: Change in discharge from previous month (percent)	Discharge near end of month: Cubic feet per second	Discharge near end of month: Million gallons per day	Discharge near end of month: Date
01014000	St. John River below Fish River at Fort Kent, Maine	5,665	9,758	2,250	46	–68	1,730	1,120	31
01318500	Hudson River at Hadley, New York	1,664	2,908	1,760	71	–62	1,170	756	31
01357500	Mohawk River at Cohoes, New York	3,456	5,683	3,010	50	–61	1,750	1,130	31
01463500	Delaware River at Trenton, New Jersey	6,780	11,670	5,465	47	–54	4,920	3,180	31
01570500	Susquehanna River at Harrisburg, Pennsylvania	24,100	34,340	13,000	38	–55	7,400	4,780	25
01646500	Potomac River near Washington, District of Columbia	11,560	[1]11,500	[1]4,470	45	–47	4,250	2,750	31
02105500	Cape Fear River at William O. Huske Lock, near Tarheel, North Carolina.	4,852	5,002	6,070	157	105	......	......	...
02131000	Pee Dee River at Peedee, South Carolina	8,830	9,871	16,110	215	75	12,400	8,010	31
02226000	Altamaha River at Doctortown, Georgia	13,600	13,730	15,920	201	147	22,200	14,400	29
02320500	Suwannee River at Branford, Florida	7,880	6,986	2,676	83	29	3,820	2,470	31
02358000	Apalachicola River at Chattahoochee, Florida	17,200	22,420	32,950	194	81	22,100	14,300	31
02467000	Tombigbee River at Demopolis lock and dam, near Coatopa, Alabama.	15,385	23,520	25,950	127	8	18,600	12,000	31
02489500	Pearl River near Bogalusa, Louisiana	6,573	9,880	13,060	238	43	8,850	5,720	31
03049500	Allegheny River at Natrona, Pennsylvania	11,410	[1]19,580	[1]13,200	50	–21	9,490	6,130	26
03085000	Monongahela River at Braddock, Pennsylvania	7,337	[1]12,480	[1]6,700	45	–46	3,610	2,330	26
03193000	Kanawha River at Kanawha Falls, West Virginia	8,367	12,550	7,565	55	–56	3,980	2,570	26
03234500	Scioto River at Higby, Ohio	5,131	4,583	1,397	34	–58	6,290	4,060	31
03294500	Ohio River at Louisville, Kentucky[2]	91,170	115,800	70,870	55	–45	78,400	50,700	31
03377500	Wabash River at Mount Carmel, Illinois	28,635	27,660	10,480	46	–54	8,800	5,690	29
03469000	French Broad River below Douglas Dam, Tennessee	4,543	[1]6,739	7,058	108	–8	......	......	...
04084500	Fox River at Rapide Croche Dam, near Wrightstown, Wisconsin.[2]	6,010	4,238	2,603	72	–13	2,460	1,590	31
04264331	St. Lawrence River at Cornwall, Ontario, near Massena, New York.[3]	298,800	243,900	237,000	99	–9	230,000	149,000	31
02NG001	St. Maurice River at Grand Mere, Quebec	16,300	24,910	10,500	79	–74	25,200	16,300	18
05082500	Red River of the North at Grand Forks, North Dakota	30,100	2,593	255	22	–42	133	85	27
05133500	Rainy River at Manitou Rapids, Minnesota	19,400	12,920	5,000	51	–31	5,400	3,490	27
05330000	Minnesota River near Jordan, Minnesota	16,200	3,680	204	31	–25	166	107	31
05331000	Mississippi River at St. Paul, Minnesota	36,800	[1]11,020	2,690	55	–34	2,230	1,440	31
05365500	Chippewa River at Chippewa Falls, Wisconsin	5,650	5,149	1,407	45	–2	600	390	31
05407000	Wisconsin River at Muscoda, Wisconsin	10,400	8,710	3,407	53	–9	3,200	2,070	31
05446500	Rock River near Joslin, Illinois	9,549	6,080	1,950	42	–26	1,500	970	31
05474500	Mississippi River at Keokuk, Iowa	119,000	63,790	18,100	50	–25	16,000	10,300	31
06214500	Yellowstone River at Billings, Montana	11,795	7,056	3,080	102	–18	3,000	1,900	31
06934500	Missouri River at Hermann, Missouri	524,200	80,880	21,620	53	–38	22,600	14,600	31
07289000	Mississippi River at Vicksburg, Mississippi[4]	1,140,500	584,000	339,500	69	–18	241,000	156,000	29
07331000	Washita River near Dickson, Oklahoma	7,202	1,402	831	231	0	1,000	600	29
08276500	Rio Grande below Taos Junction Bridge, near Taos, New Mexico.	9,730	742	346	81	22	340	219	31
09315000	Green River at Green River, Utah	44,850	6,391	1,495	62	–32	......	......	...
11425500	Sacramento River at Verona, California	21,251	19,430	13,780	66	11	2,526	1,630	21
13269000	Snake River at Weiser, Idaho	69,200	18,520	11,500	74	–8	11,200	7,240	31
13317000	Salmon River at White Bird, Idaho	13,550	11,390	3,590	78	–16	3,410	2,200	31
13342500	Clearwater River at Spalding, Idaho	9,570	15,510	7,110	112	42	4,570	2,950	31
14105700	Columbia River at The Dalles, Oregon[5]	237,000	[1]193,500	[1]104,100	119	–8	161,000	104,000	20
14191000	Willamette River at Salem, Oregon	7,280	[1]23,690	[1]18,920	43	105	11,300	7,300	21
15515500	Tanana River at Nenana, Alaska	25,600	23,810	8,929	132	–2	8,800	5,690	31
08MF005	Fraser River at Hope, British Columbia	83,800	96,250	48,730	111	–32	69,200	44,700	31

[1]Adjusted.

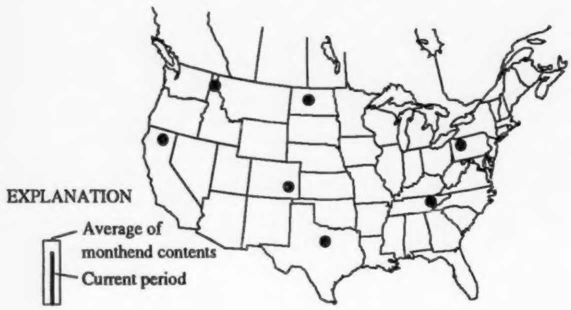
[2]Records furnished by Corps of Engineers.

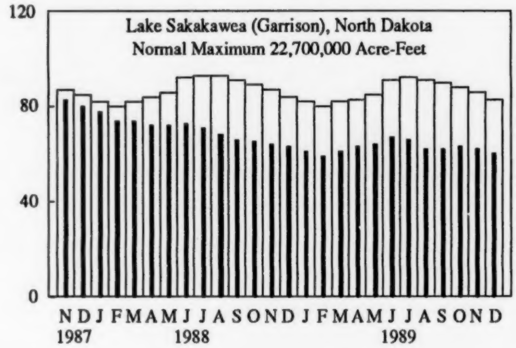
[3]Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y., when adjusted for storage in Lake St. Lawrence.

[4]Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.

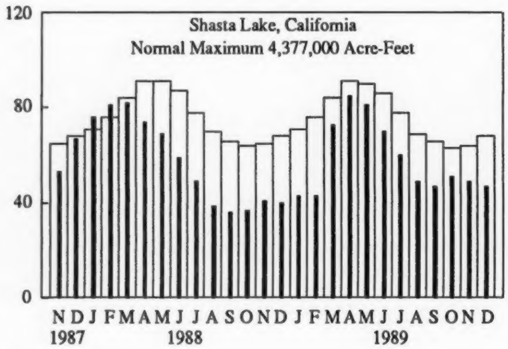
[5]Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

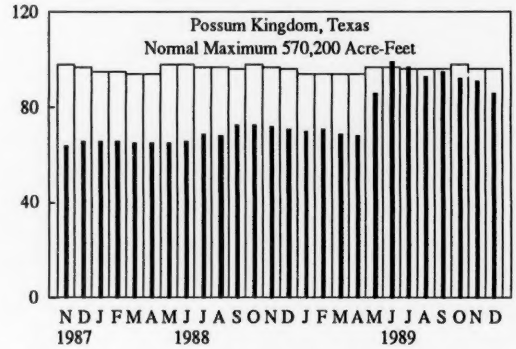
USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS

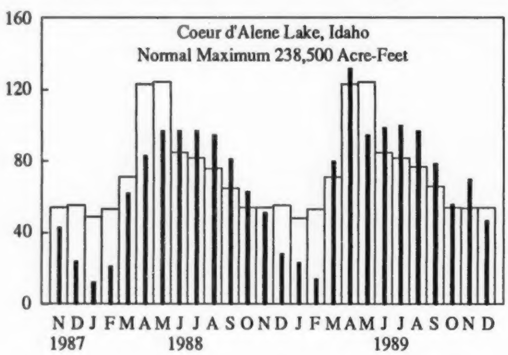


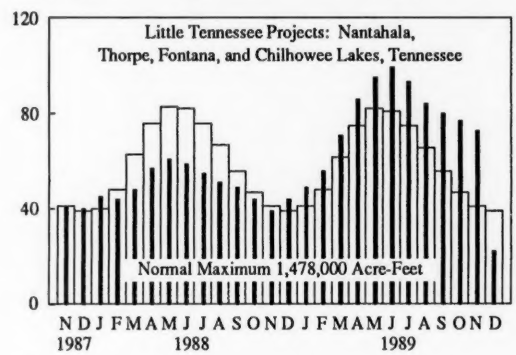


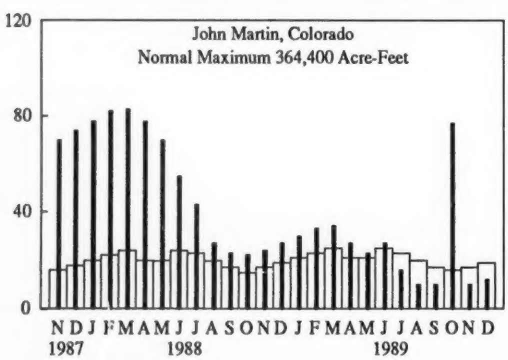
PERCENT OF NORMAL MAXIMUM

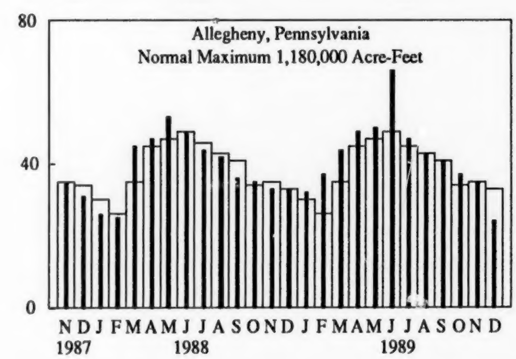












Provisional data; subject to revision

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF DECEMBER 1989

[Contents are expressed in percent of reservoir (system) capacity. The usable storage capacity of each reservoir (system) is shown in the column headed "Normal maximum"]

Reservoir Principal uses: F-Flood control I-Irrigation M-Municipal P-Power R-Recreation W-Industrial	Percent of normal maximum: End of December 1989	Percent of normal maximum: End of December 1988	Percent of normal maximum: Average for end of December	Percent of normal maximum: End of November 1989	Normal maximum (acre-feet)[a]
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	45	61	50	47	[b]226,300
QUEBEC					
Allard (P)	71	80	58	87	280,600
Gouin (P)	57	71	66	58	6,954,000
MAINE					
Seven Reservoir Systems (MP)	54	60	57	63	4,107,000
NEW HAMPSHIRE					
First Connecticut Lake (P)	52	63	58	77	76,450
Lake Francis (FPR)	67	74	70	85	99,310
Lake Winnipesaukee (PR)	64	67	62	80	165,700
VERMONT					
Harriman (P)	59	70	60	82	116,200
Somerset (P)	75	82	68	87	57,390
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	84	77	72	93	77,920
NEW YORK					
Great Sacandaga Lake (FPR)	55	50	53	80	786,700
Indian Lake (FMP)	60	62	62	71	103,300
New York City Reservoir System (MW)	84	60	82	89	1,680,000
NEW JERSEY					
Wanaque (M)	86	86	72	95	77,450
PENNSYLVANIA					
Allegheny (FPR)	24	33	33	35	1,180,000
Pymatuning (FMR)	82	85	82	95	188,000
Raystown Lake (FR)	61	66	57	67	761,900
Lake Wallenpaupack (PR)	54	69	57	60	157,800
MARYLAND					
Baltimore Municipal System (M)	88	73	83	91	261,900
NORTH CAROLINA					
Bridgewater (Lake James) (P)	91	91	78	93	288,800
Narrows (Badin Lake) (P)	91	94	93	95	128,900
High Rock Lake (P)	80	35	60	83	234,800
SOUTH CAROLINA					
Lake Murray (P)	85	78	62	88	1,614,000
Lakes Marion and Moultrie (P)	77	65	61	81	1,862,000
SOUTH CAROLINA-GEORGIA					
Strom Thurmond Lake (FP)	68	20	52	76	1,730,000
GEORGIA					
Burton (PR)	83	80	55	95	104,000
Sinclair (MPR)	89	93	76	65	214,000
Lake Sidney Lanier (FMPR)	64	35	50	64	1,686,000
ALABAMA					
Lake Martin (P)	73	73	61	77	1,375,000
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	38	37	31	49	2,293,000
Douglas Lake (FPR)	16	13	11	34	1,395,000
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	52	43	39	63	1,012,000
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	41	39	33	55	2,880,000
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	22	44	39	73	1,478,000
WISCONSIN					
Chippewa and Flambeau (PR)	74	89	64	75	365,000
Wisconsin River (21 Reservoirs) (PR)	36	59	55	39	399,000
MINNESOTA					
Mississippi River Headwater System (FMR)	29	35	24	32	1,640,000
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	60	63	83	62	22,700,000
SOUTH DAKOTA					
Angostura (I)	43	45	70	41	130,770
Belle Fourche (I)	23	32	44	21	185,200
Lake Francis Case (FIP)	60	60	59	53	4,589,000
Lake Oahe (FIP)	57	63	–	57	22,240,000
Lake Sharpe (FIP)	102	101	98	101	1,697,000
Lewis and Clark Lake (FIP)	100	96	100	101	432,000
NEBRASKA					
Lake McConaughy (IP)	64	72	72	62	1,948,000
OKLAHOMA					
Eufaula (FPR)	98	97	88	98	2,378,000
Keystone (FPR)	85	82	93	85	661,000
Tenkiller Ferry (FPR)	104	103	95	104	628,200
Lake Altus (FIMR)	68	73	49	68	133,000
Lake O'The Cherokees (FPR)	87	90	82	87	1,492,000
OKLAHOMA-TEXAS					
Lake Texoma (FMPRW)	89	87	90	89	2,722,000
TEXAS					
Bridgeport (IMW)	88	58	48	94	386,400
Canyon (FMR)	85	97	80	88	385,600
International Amistad (FIMPW)	82	103	85	84	3,497,000
International Falcon (FIMPW)	50	166	79	46	2,668,000
Livingston (IMW)	97	80	89	91	1,788,000
Possum Kingdom (IMPRW)	86	71	96	91	570,200
Red Bluff (P)	31	58	31	30	307,000
Toledo Bend (P)	81	84	84	84	4,472,000
Twin Buttes (FIM)	48	71	34	49	177,800
Lake Kemp (IMW)	93	63	84	96	268,000
Lake Meredith (FMW)	40	42	37	40	796,900
Lake Travis (FIMPRW)	64	80	80	64	1,144,000
MONTANA					
Canyon Ferry (FIMPR)	75	70	85	77	2,043,000
Fort Peck (FPR)	61	68	83	62	18,910,000
Hungry Horse (FIPR)	73	47	75	69	3,451,000
WASHINGTON					
Ross (PR)	82	65	69	82	1,052,000
Franklin D. Roosevelt Lake (IP)	95	46	93	95	5,022,000
Lake Chelan (PR)	61	62	55	74	676,100
Lake Cushman (PR)	23	56	81	21	359,500
Lake Merwin (P)	102	98	96	103	245,600
IDAHO					
Boise River (4 Reservoirs) (FIP)	42	29	56	40	1,235,000
Coeur d'Alene Lake (P)	47	28	54	70	238,500
Pend Oreille Lake (FP)	26	28	48	15	1,561,000
IDAHO-WYOMING					
Upper Snake River (8 Reservoirs) (MP)	58	34	59	50	4,401,000
WYOMING					
Boysen (FIP)	77	61	75	82	802,000
Buffalo Bill (IP)	53	37	67	51	421,300
Keyhole (F)	21	27	42	21	193,800
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	37	53	49	36	3,056,000
COLORADO					
John Martin (FIR)	12	27	19	10	364,400
Taylor Park (IR)	70	67	55	72	106,200
Colorado-Big Thompson Project (I)	37	65	58	37	730,300
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IFPR)	75	84	–	77	31,620,000
UTAH-IDAHO					
Bear Lake (IPR)	50	56	59	50	1,421,000
CALIFORNIA					
Folsom (FIP)	33	24	54	34	1,000,000
Hetch Hetchy (MP)	43	41	37	50	360,400
Isabella (FIR)	15	13	26	16	568,100
Pine Flat (FI)	7	10	47	6	1,001,000
Clair Engle Lake (Lewiston) (P)	52	52	73	52	2,438,000
Lake Almanor (P)	66	64	50	71	1,036,000
Lake Berryessa (FIMW)	50	62	79	50	1,600,000
Millerton Lake (FI)	32	36	54	29	503,200
Shasta Lake (FIPR)	47	40	68	49	4,377,000
CALIFORNIA-NEVADA					
Lake Tahoe (IPR)	0	0	46	8	744,600
NEVADA					
Rye Patch (I)	6	4	53	5	194,300
ARIZONA-NEVADA					
Lake Mead and Lake Mohave (FIMP)	83	88	72	82	27,970,000
ARIZONA					
San Carlos (IP)	6	47	24	6	935,100
Salt and Verde River System (IMPR)	49	79	42	50	2,019,100
NEW MEXICO					
Conchas (FIR)	66	80	83	63	315,700
Elephant Butte and Caballo (FIPR)	73	87	38	70	2,397,000

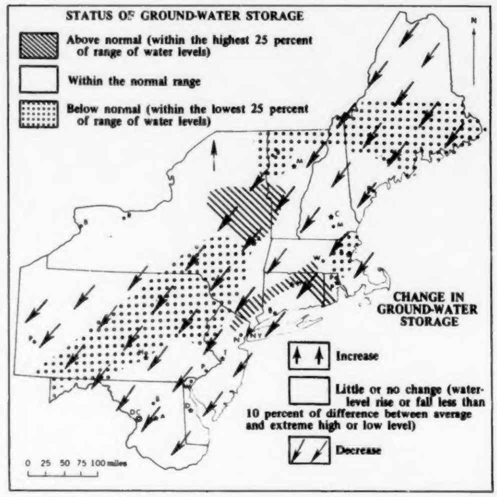
[a]1 acre-foot = 0.04356 million cubic feet = 0.326 million gallons = 0.504 cubic feet per second per day.

[b]Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

GROUND-WATER CONDITIONS DURING DECEMBER 1989

Ground-water levels declined throughout most of the Northeast because below freezing temperatures throughout the region during December decreased recharge. The only exception to this declining trend was a small area in northeastern New York where levels rose. (See map.) Above-average water levels persisted only in a few places in the central part of the region (parts of New York, Vermont, Massachusetts, and New Jersey). Levels were below normal in much of the southwestern and northeastern parts of the region: specifically in much of Pennsylvania and Maine, and also in parts of New Jersey, New York, Massachusetts, Vermont, and New Hampshire.

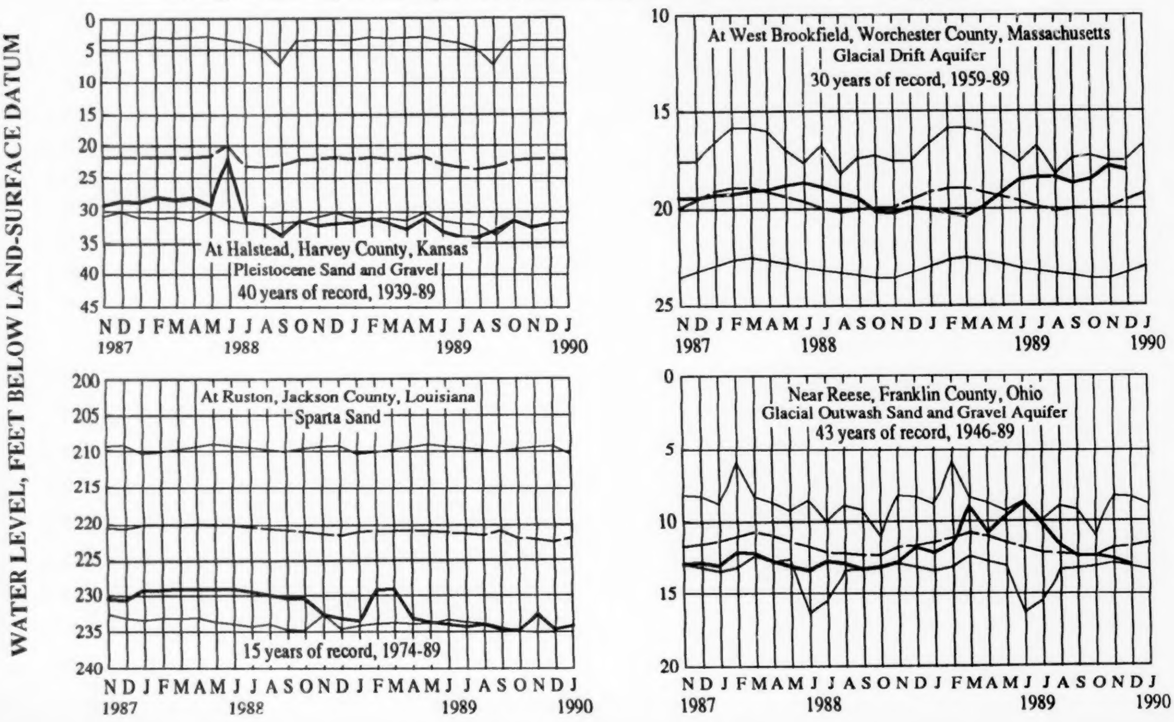
In the Southeastern States, ground-water levels rose only in North Carolina and Arkansas. Levels declined in Kentucky, most of West Virginia, and Mississippi. Net changes in levels were mixed in Virginia and Georgia. Water levels were above long-term averages in Kentucky and North Carolina, below average in Arkansas and Louisiana, and mixed with respect to average elsewhere in the Southeast. A record monthly high water level occurred in the key well in Glenville, West Virginia, in spite of a slight decline since last month. A record monthly



Map showing ground-water storage near end of December and change in ground-water storage from end of November to end of December.

MONTHEND GROUND-WATER LEVELS IN KEY WELLS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates average of monthly levels in previous years. Heavy line indicates level for current period.



low occurred at Cockspur Island near Savannah, Georgia, in spite of a rise in water level since last month. The water level in the key well in Ruston, Louisiana, remained at the all-time record-low level set last month.

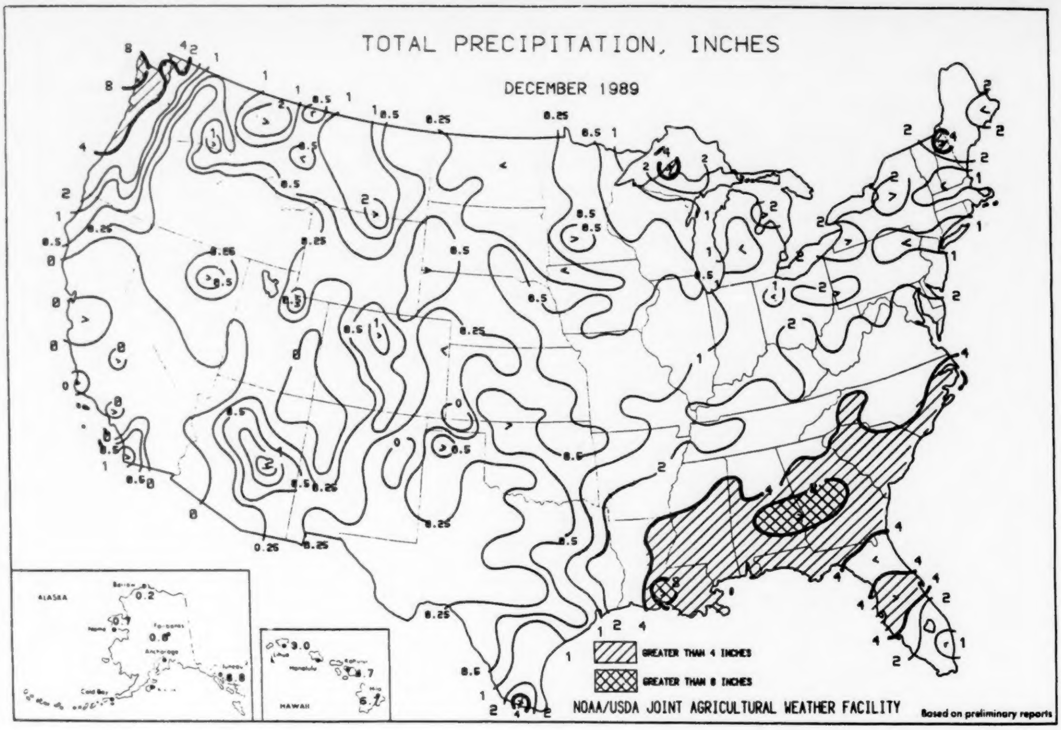
Ground-water levels declined throughout most of the central and western Great Lakes States. The exception was Minnesota where changes were mixed with respect to last month. Water levels were below long-term averages in Wisconsin, Ohio, and Iowa, and mixed with respect to average elsewhere.

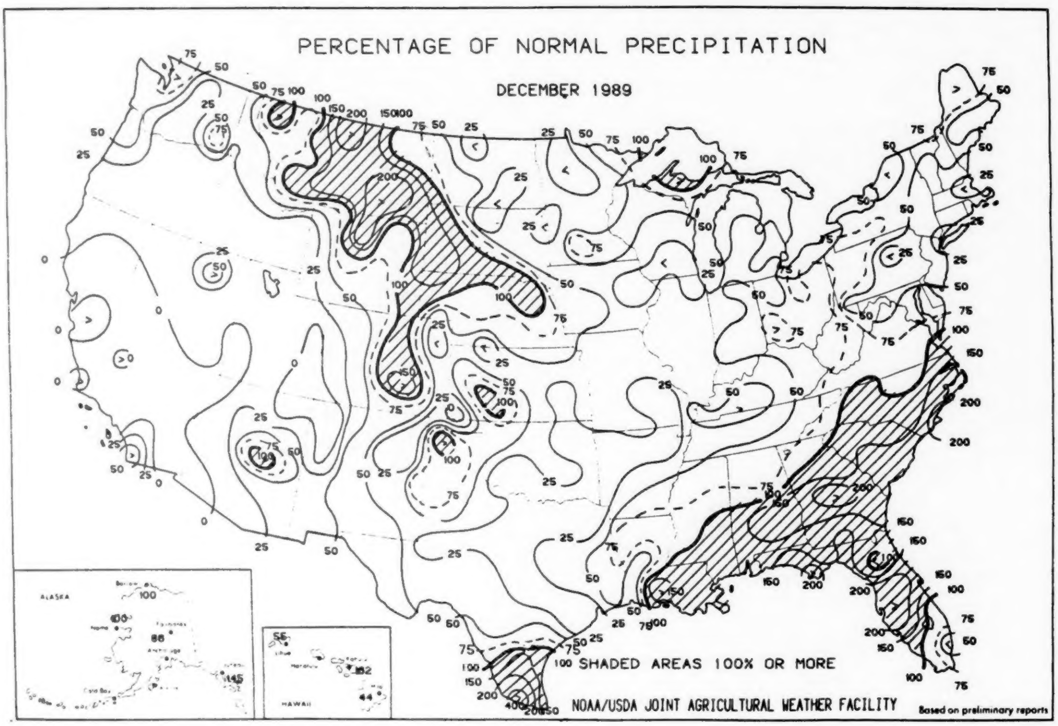
In the Western States, water levels rose in Washington, Nebraska, and Arizona, and declined in Idaho, North Dakota, and southern California. Changes in water levels were mixed in Nevada, Utah, Kansas, New Mexico, and Texas. Levels were below long-term averages in many Western States: Idaho, North Dakota, Nebraska, southern California, Utah, Kansas, and Arizona. Elsewhere in the region, water levels were mixed with respect to average. Record-low water levels occurred in key wells in Las Vegas Valley, Nevada; and Holladay, Utah, in spite of a rise in level since last month; and also at El Paso, Texas.

Provisional data; subject to revision

WATER LEVELS IN KEY OBSERVATION WELLS IN SOME REPRESENTATIVE AQUIFERS IN THE CONTERMINOUS UNITED STATES--DECEMBER 1989

Aquifer and Location	Water level in feet with reference to land-surface datum	Departure from average in feet	Net change in water level in feet since: Last month	Last year	Year records began	Remarks
Glacial drift at Hanska, south-central Minnesota	-16.86	-8.37	-1.17	-5.16	1942	
Glacial drift at Roscommon in north-central part of Lower Peninsula, Michigan.	-5.69	-0.89	-0.14	-1.51	1935	
Glacial drift at Marion, Iowa..............................	-10.25	-4.05	-0.69	-2.17	1941	
Glacial drift at Princeton in northwestern Illinois.....	-7.65	+6.26	-0.40	+1.00	1943	
Petersburg Granite, southeastern Piedmont near Fall Zone, Colonial Heights, Virginia.	-14.80	+1.20	+0.05	+2.49	1939	
Glacial outwash sand and gravel, Louisville, Kentucky (U.S. well no. 2).	-19.25	+5.71	-0.24	-1.36	1946	
500-foot sand aquifer near Memphis, Tennessee (U.S. well no. 2).	-106.92	-16.38	-0.07	+0.29	1941	
Weathered granite, Mocksville area, Davie County, western Piedmont, North Carolina.	-15.83	+4.68	+0.58	+3.85	1932	
Sparta Sand in Pine Bluff industrial area, Arkansas ..	-238.05	-28.65	+0.95	+4.05	1958	
Eutaw Formation in the City of Montgomery, Alabama (U.S. well no. 4).	-25.4	-3.3	+1.2	+2.7	1952	
Upper Floridan aquifer on Cockspur Island, Savannah area, Georgia (U.S. well no. 6).	-36.23	-8.84	+0.18	-0.45	1956	Dec. low
Sand and gravel in Puget Trough, Tacoma, Washington.	-106.23	+3.04	+0.76	-1.17	1952	
Pleistocene glacial outwash gravel, North Pole, northern Idaho (U.S. well no. 3).	-467.1	-5.5	-0.7	+2.0	1929	
Snake River Group: Snake River Plain Aquifer, at Eden, Idaho (U.S. well no. 4).	-123.1	-5.2	-2.2	+0.8	1957	
Alluvial valley fill in Flowell area, Millard County, Utah (U.S. well no. 9).	-27.79	-1.49	+1.09	-8.35	1929	
Alluvial sand and gravel, Platte River Valley, Ashland, Nebraska (U.S. well no. 6).	-6.88	-0.73	+1.09	+0.09	1935	
Alluvial valley fill in Steptoe Valley, Nevada.........	-7.41	+5.03	+0.26	-0.23	1950	
Pleistocene terrace deposits in Kansas River valley, at Lawrence, northeastern Kansas.	-23.46	-2.70	+0.04	+0.03	1953	
Alluvium and Paso Robles clay, sand, and gravel, Santa Maria Valley, California.	-149.9	-7.1	+1.1	-3.73	1957	
Valley fill, Elfrida area, Douglas, Arizona (U.S. well no. 15).	-99.47	-17.57	+0.11	+1.23	1951	
Hueco bolson, El Paso area, Texas	-269.96	-20.64	+0.79	-1.41	1965	Dec. low
Evangeline aquifer, Houston area, Texas	-297.85	+4.65	+1.22	+7.05	1965	





(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Facility)

December in Historical Perspective

December 1989 was the 4th coldest December since 1895 based on a preliminary value with a standard error of estimate of 0.26 degrees, indicated by the + in figure 1. The coldest December occurred in 1983. The standardized national precipitation also indicates that December 1989 was the 3rd driest on record (fig. 2).

The temperature and precipitation rankings for December 1989 for the nine climatically homogeneous regions (see Weekly Weather and Crop Bulletin, Dec. 12, 1989, p. 8, Vol. 76, No. 49 for the regions) are listed in table 1. The Northeast, Central, and Southeast regions were the coldest on record, while the East North Central and South were the 2nd coldest. The western regions were relatively warm. Much of the Nation was dry during December, with only the Southeast and West North Central being relatively wet and ranking as more than the 12th driest. The West ranked as the driest ever.

In the Northwest region, the October through December period has been unusually dry for the last five consecutive years, in contrast to the first half of the 1980's (fig. 3). Combined October-December precipitation averaged across the Hard Red Winter wheat region in the central and southern Plains ranks 1989 as the 6th driest such period on record (fig. 4). The dryness of the last 2 years contrasts with the unusually wet October through December periods of the mid-1980's.

Figure 1

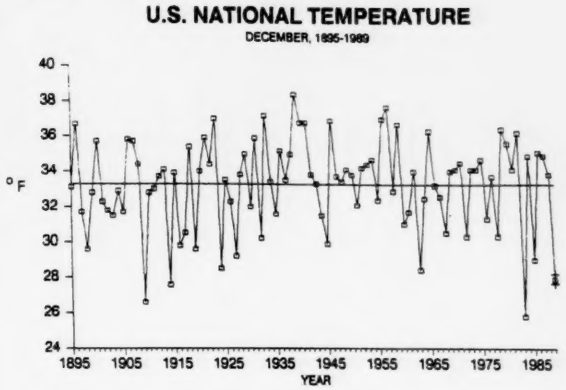


TABLE 1. TEMPERATURE AND PRECIPITATION RANKINGS FOR DEC 1989, BASED ON THE PERIOD 1895-1989. 1 = DRIEST/COLDEST, 95 = WETTEST/HOTTEST.

REGION	PRECIPITATION	TEMPERATURE
NATIONAL	3	4
NORTHEAST	8	1
EAST NORTH CENTRAL	6	2
CENTRAL	8	1
SOUTHEAST	69	1
WEST NORTH CENTRAL	51	22
SOUTH	12	2
SOUTHWEST	11	49
NORTHWEST	7	55
WEST	1	58

Figure 2

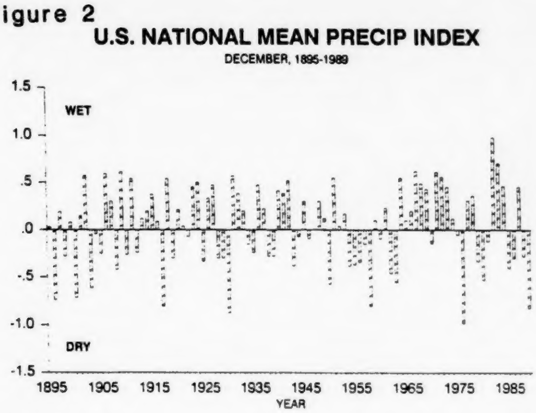


Figure 3

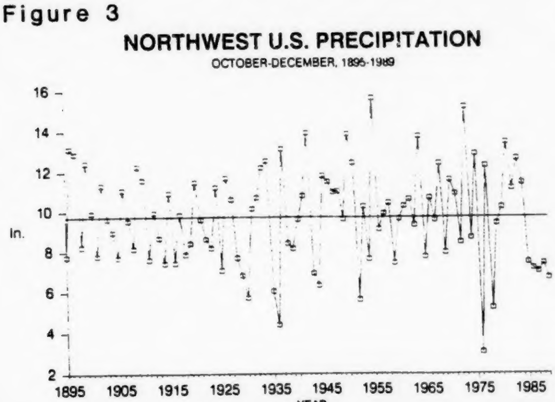
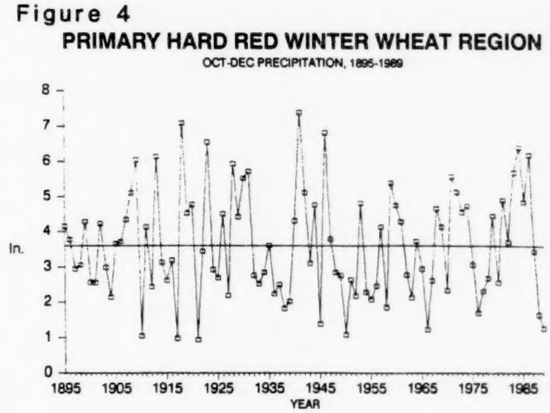


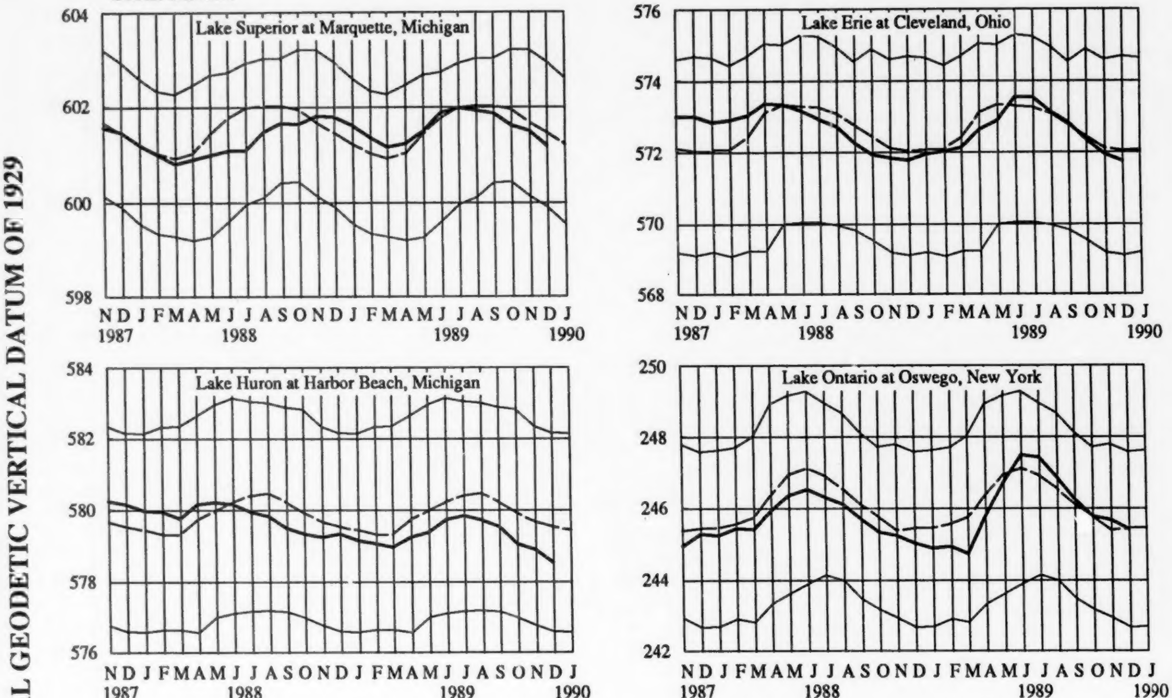
Figure 4



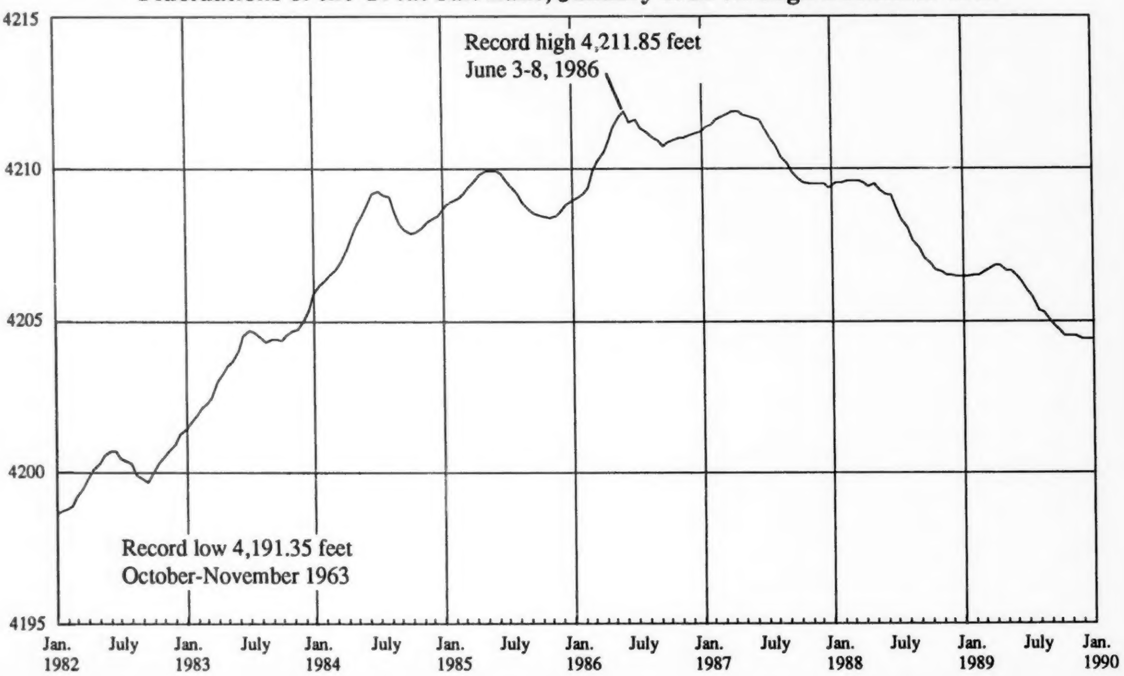
(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Facility)

GREAT LAKES ELEVATIONS

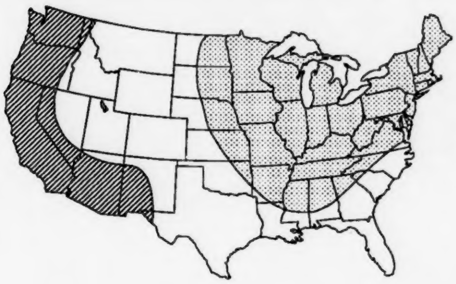
Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period. Data from National Ocean Service.

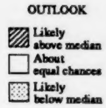


Fluctuations of the Great Salt Lake, January 1982 through December 1989

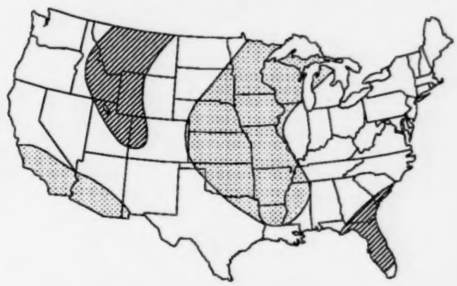


TEMPERATURE OUTLOOK FOR JANUARY-MARCH 1990





PRECIPITATION OUTLOOK FOR JANUARY-MARCH 1990



NATIONAL WATER CONDITIONS

DECEMBER 1989

Based on reports from the Canadian and U.S. Field offices; completed January 23, 1990

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EXPLANATION OF DATA (Revised December 1989)

Cover map shows generalized pattern of streamflow for the month based on provisional data from 186 index gaging stations—18 in Canada, 166 in the United States, and 2 in the Commonwealth of Puerto Rico. Alaska, Hawaii, and Puerto Rico inset maps show streamflow only at the index gaging stations that are located near the point shown by the arrows. Classifications on map are based on comparison of streamflow for the current month at each index station with the flow for the same month in the 30-year reference period, 1951-80. Shorter reference periods are used for one Canadian index station, two Kansas index stations, and the Puerto Rico index stations because of the limited records available.

The ***streamflow ranges map*** shows where streamflow has persisted in the above- or below-normal range from last month to this month and also where streamflow is in the above- or below-normal range this month after being in a different range last month. Three ***pie charts*** show: the percent of stations reporting discharges in each flow range for both the conterminous United States and southern Canada, and also the percent of area in each flow range for the conterminous United States and southern Canada. The ***bar graph*** shows total mean and total median flow for all reporting stations in the conterminous United States and southern Canada.

The comparative data are obtained by ranking the 30 flows for each month of the reference period in order of decreasing magnitude—the highest flow is given a ranking of 1 and the lowest flow is given a ranking of 30. Quartiles (25-percent points) are computed by averaging the 7th and 8th highest flows (upper quartile), 15th and 16th highest flows (middle quartile and median), and the 23rd and 24th highest flows (lower quartile). The upper and lower quartiles set off the highest 25 percent of flows and lowest 25 percent of flows, respectively, for the reference period. The median (middle quartile) is the middle value by definition. For the reference period, 50 percent of the flows are greater than the median, 50 percent are less than the median, 50 percent are between the upper and lower quartiles (in the normal range), 25 percent are greater than the upper quartile (above normal), and 25 percent are less than the lower quartile (below normal). Flow for the current month is then classified as: in the ***above-normal range*** if it is greater than the upper quartile, in the ***normal range*** if it is between the upper and lower quartiles, and in the ***below-normal range*** if it is less than the lower quartile. Change in flow from the previous month to the current month is classified as ***seasonal*** if the change is in the same direction as the change in the median. If the change is in the opposite direction of the change in the median, the change is classified as ***contraseasonal*** (opposite to the seasonal change). For example: at a particular index station, the January median is greater than the December median; if flow for the current January increased from December (the previous month), the increase is seasonal; if flow for the current January decreased from December, the decrease is contraseasonal.

Flood frequency analyses define the relation of flood peak magnitude to probability of occurrence or recurrence interval. ***Probability of occurrence*** is the chance that a given flood magnitude will be exceeded in any one year. ***Recurrence interval*** is the reciprocal of probability of occurrence and is the average number of years between occurrences. For example, a flood having a probability of occurrence of 0.01 (1 percent) has a recurrence interval of 100 years. ***Recurrence intervals imply no regularity of occurrence***; a 100-year flood might be exceeded in consecutive years or it might not be exceeded in a 100-year period.

Statements about ***ground-water levels*** refer to conditions near the end of the month. The water level in each key observation well is compared with average level for the end of the month determined from the 30-year reference period, 1951-80, or from the entire past record for that well when only limited records are available. Comparative data for ground-water levels are obtained in the same manner as comparative data for streamflow. ***Changes in ground-water levels***, unless described otherwise, are from the end of the previous month to the end of the current month.

Dissolved solids and temperature data are given for five stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). ***Dissolved solids*** are minerals dissolved in water and usually consist predominately of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. ***Dissolved-solids discharge*** represents the total daily amount of dissolved minerals carried by the stream. ***Dissolved-solids concentrations*** are generally higher during periods of low streamflow, but the highest dissolved-solids discharges occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

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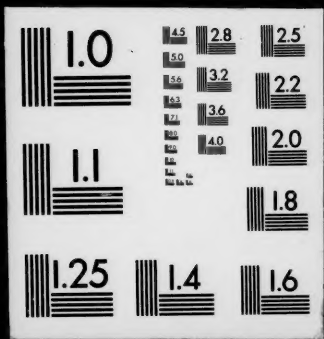
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